ERASMUS UNIVERSITEIT ROTTERDAM

Erasmus University Rotterdam, the Netherlands
CSC PhD 2015 Project Description

School/Department:	Erasmus MC University Medical Center, Department of Epidemiology
Project Title:	Quantitative analysis of brain connectivity in neuropsychiatric diseases.
Abstract:	**Background:** Neuropsychiatric diseases, such as dementia and depression, often co-occur and pose a huge burden on societies worldwide, both in terms of financial costs and suffering for patients and caregivers. The causes of these diseases are still not entirely elucidated, but emerging evidence suggests that an important role may be played by abnormal 'brain wiring', often termed dis-connectivity. Advanced imaging techniques are now available to study this connectivity, both with structural measures using diffusion tensor imaging (DTI) and with functional measures using resting state functional MRI (rs-fMRI). This project aims to study the causes and consequences of brain connectivity in the etiology of dementia and depression. Two sub-aims are specified: - to learn and develop novel techniques to process DTI and rs-fMRI data. - to apply these techniques in the study of dementia and depression. **Methods:** This PhD-project will be embedded in the Rotterdam Study, a long-standing cohort study that has been ongoing for 25 years and currently includes nearly 15,000 participants. Among the whole cohort repeated MRI-data are available in over 7,000 persons, which makes this the single largest population-based neuro-imaging dataset worldwide. Information on depression and dementia status in the whole cohort is collected routinely and is available for the whole study period. The total number of incident cases exceeds 1,000 for both outcomes. In addition, extensive cognitive and psychiatric testing has taken place at multiple time-points using dedicated test batteries. These data can also be used in this project. Statistical analysis will make use of advanced regression-based techniques. **Expected results:** We seek to acquire novel insights into the role of brain connectivity in the etiology of dementia and depression. Additionally, novel MRI-processing techniques applied in this project will then be available to be applied to other neuropsychiatric diseases, such as stroke and

	anxiety.
Requirements of candidate:	**Master degree:** Yes **Background:** A Masters (or equivalent degree) in one of the following or related fields is recommended: medicine, bioinformatics, neuroscience, biomedical sciences, biomedical engineering, life sciences, biostatistics, neuropsychology, biological psychology. The successful candidate is expected to have the necessary skills to process advanced MRI-data within the framework of large datasets. The ability to apply (and ideally develop) novel image processing tools on large datasets would greatly facilitate the success of this project. Additionally, a good command of biostatistical techniques in an epidemiological framework is recommended. The successful candidate ideally has above basic understanding of one or more of the following image processing and statistical packages: FSL, FreeSurfer, SPSS, R, SAS, STATA. Familiarity with Linux operating systems is recommended. IELTS Grade: 7.0 *(minimal 6.0 per component)* *or* TOEFL: *100 (minimal 20 per component)*
Supervisor information:	Dr. M. Arfan Ikram m.a.ikram@erasmusmc.nl Dr. Meike W. Vernooij m.vernooij@erasmusmc.nl Prof. Henning Tiemeier h.tiemeier@erasmusmc.nl **Relevant publications:** 1. de Groot M, Ikram MA, Akoudad S, Krestin GP, Hofman A, van der Lugt A, Niessen WJ, Vernooij MW. Tract-specific white matter degeneration in aging. The Rotterdam Study. *Alzheimers Dement.* 2014 in press. 2. de Bruijn RF, Akoudad S, Cremers LG, Hofman A, Niessen WJ,

	van der Lugt A, Koudstaal PJ, Vernooij MW, Ikram MA. Determinants, MRI correlates, and prognosis of mild cognitive impairment: the rotterdam study. *J Alzheimers Dis*. 2014;42(0):S239-49. 3. Adams HH, Verhaaren BF, Vrooman HA, Uitterlinden AG, Hofman A, van Duijn CM, van der Lugt A, Niessen WJ, Vernooij MW, Ikram MA. TMEM106B Influences Volume of Left-Sided Temporal Lobe and Interhemispheric Structures in the General Population. *Biol Psychiatry*. 2014;76(6):503-8. 4. Mirza SS, de Bruijn RF, Direk N, Hofman A, Koudstaal PJ, Ikram MA, Tiemeier H. Depressive symptoms predict incident dementia during short- but not long-term follow-up period. *Alzheimers Dement*. 2014 in press. 5. Akoudad S, de Groot M, Koudstaal PJ, van der Lugt A, Niessen WJ, Hofman A, Ikram MA, Vernooij MW. Cerebral microbleeds are related to loss of white matter structural integrity. *Neurology*. 2013;81(22):1930-7. 6. van Velsen EF, Vernooij MW, Vrooman HA, van der Lugt A, Breteler MM, Hofman A, Niessen WJ, Ikram MA. Brain cortical thickness in the general elderly population: the Rotterdam Scan Study. *Neuroscience Letters*. 2013;550:189-94. 7. de Groot M, Vernooij MW, Klein S, Ikram MA, Vos FM, Smith SM, Niessen WJ, Andersson JL. Improving alignment in Tract-based spatial statistics: evaluation and optimization of image registration. *Neuroimage*. 2013;76:400-11. 8. de Groot M, Verhaaren BF, de Boer R, Klein S, Hofman A, van der Lugt A, Ikram MA, Niessen WJ, Vernooij MW. Changes in normal-appearing white matter precede development of white matter lesions. *Stroke*. 2013;44(4):1037-42. 9. Ikram MA, van der Lugt A, Niessen WJ, Krestin GP, Koudstaal PJ, Hofman A, Breteler MM, Vernooij MW. The Rotterdam Scan Study: design and update up to 2012. *Eur J Epidemiol* 2011;26(10):811-24. 10. Vernooij MW, Ikram MA, Vrooman HA, Wielopolski PA, Krestin GP, Hofman A, Niessen WJ, Van der Lugt A, Breteler MM. White matter microstructural integrity and cognitive function in a general elderly population. *Arch Gen Psychiatry*. 2009;66(5):545-53.

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