

## Thesis abstract

# White matter microstructural decline and cognitive performance in older adults: the influence of cardiovascular health

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Age-related cognitive decline is well documented, especially in memory, speed of processing and executive functions. Structural brain changes are also well documented but often do not directly map onto the mild cognitive decline seen in otherwise healthy older adults. Recent work has focused on whether cognitive ageing is associated with decline in the strength of structural connectivity between neural regions, using diffusion magnetic resonance imaging (dMRI). Reduced integrity of white matter microstructure across the whole brain and in regions of interest, as measured by fractional anisotropy (FA), has been shown to be associated with cognitive decline in older adults who show no signs of dementia. This thesis uses dMRI tractography to examine the association between multiple measures of white matter microstructure across the whole brain and in 18 major white matter tracts and cognitive performance on a range of tasks that vary in process specificity. Seventy non-demented older adults (aged 43-87y) with varying degree of white matter disease completed a comprehensive cognitive and imaging assessment. Cognitive functioning was assessed at three levels: Firstly, global cognitive functioning was assessed using the Montreal Cognitive Assessment (MoCA). Then through the use of standardised neuropsychological tests, more specific

cognitive domains of working memory, episodic memory, executive function and processing speed were assessed. An experimental task switching paradigm was then used to assess more specific components of executive function relating to proactive and reactive control processes. These showed that ability to detect the impact of tract-specific changes in white matter microstructure on cognitive performance was dependent on the specificity of the cognitive test. Although, irrespective of the level of cognitive assessment, the relationship between decline in white matter microstructural integrity and cognitive performance was specific only to participants with poor cardiovascular health. These findings suggest that cognitive and brain ageing profiles in older adults vary as a function of cardiovascular health and have strong implications for theories of cognitive ageing. They also emphasise the importance of cardiovascular health in prevention or delay in onset of cognitive decline in old age.

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