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Biomarkers to unlock the Alzheimer's disease pre-symptomatic window: Results from the AIBL Study

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Abstract

The Australian Imaging, Biomarkers and Lifestyle study (AIBL) aims to monitor biomarkers, in their various forms, and assess their potential to aid the quest for a cure for Alzheimer's disease. Alzheimer's disease, the leading cause of dementia, currently costs 1% of GDP globally[1]. With the incidence of this disease predicted to increase at least three fold by 2050 we are faced with an unprecedented challenge to cure this disease.

The longitudinal assessment of disease-specific biomarkers such as β-amyloid and tau in cerebrospinal fluid, structural, metabolic and neurochemical alterations in the brain measured through MRI and PET scanning, as well as clinical, neuropsychological and cognitive assessments allow a better picture of disease progression and the elucidation of its underlying mechanisms, essentially providing a map of the disease course[2].

New treatment strategies aim at early-intervention, thus, there is an urgent need for pre-symptomatic detection of at risk individuals (identify those at a particular point on the map). Current disease-specific gold standards, namely A imaging with PET and assessment of A and tau in cerebro-spinal fluid, are either too costly or invasive for widespread population screening, therefore, new biomarkers (e.g. blood) which act as proxy measurements for the gold standards need to be developed[3].

Suitable biomarker levels and their rates of change will also be required to assess the efficacy of various intervention strategies, i.e. to where someone is, where they are going and how fast they will get there compared to where they were, where they are and how long it took them[4].

Novel non-invasive biomarkers for particular traits of the pathological process are needed. It is unlikely that a single biomarker will be effective and a multimodality approach for accurate and early diagnosis, monitoring disease progression, and better treatment follow-up is warranted.

Biography

Samantha Burnham's research experience is in the use of mathematical, statistical and engineering principals, specifically complex systems analysis, for solving problems in the pharmaceutical and biomedical fields. Her current research is primarily focused on the development of early screening tests, biomarker discovery, quantification of disease severity and enhancing the understanding of the disease pathway for Alzheimer's disease. She completed a PhD in Chemical Engineering focussed on the automated elucidation of reaction mechanism to reduce time to market for pharmaceutical industry in 2008 at Newcastle University, UK. Dr Burnham then spent a year as a teaching and research fellow at Curtin University continuing her research on mechanism determination before joining CSIRO in 2009 as an OCE postdoctoral-fellow investigating biomarkers for Alzheimer's disease.

Since joining CSIRO in 2009, Dr Burnham has identified a panel of blood-based markers that accurately (>80%) estimate the level of neocortical Amyloid burden (an early indicator and pathological feature in Alzheimer's disease) and developed a protocol to analyse cohort data for quantifying the pathogenesis of Alzheimer's disease. She is currently focussing her efforts on identifying markers of disease severity with application in assessing the efficacy of intervention or therapeutic trials.