

# Several methods for early diagnosis of Alzheimer's disease developed by European scientists

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PredictAD is an EU-funded research project that develops objective and efficient methods for enabling earlier diagnosis of Alzheimer's disease. Diagnosis requires a holistic view of the patient combining information from several sources, such as, clinical tests, imaging and blood samples.

"The aim of the PredictAD project is to develop an objective indicator to diagnose Alzheimer's [disease](#) at the earliest stage possible. Current diagnostic guidelines emphasise the importance of various [biomarkers](#) in diagnostics. We have developed novel approaches to extract biomarkers from imaging data, electrophysiological data and [blood samples](#), and a unique and clinically useful [software tool](#) for integrating all these heterogeneous [measurements](#)." says the Scientific Coordinator of the project, Dr Jyrki Lötjönen from VTT Technical Research Centre of Finland.

## Magnetic resonance imaging for identifying atrophy

Atrophy in the mediotemporal lobe is a well-known hallmark of Alzheimer's disease. Magnetic resonance imaging is an excellent tool for measuring this tissue loss. In current clinical practice, images are interpreted mostly only by visual inspection but there is a great need for objective measurements.

PredictAD has developed several methods to meet this need. "We have

managed to develop efficient tools for measuring the size of the hippocampus, the atrophy rate of the hippocampus, and two modern approaches based on comparing patient data with previously diagnosed cases available in large databases." says the leader of the imaging biomarkers work-package, professor Daniel Rueckert from Imperial College London. Positron emission tomography (PET) imaging is another imaging technology studied in the project. A novel tracer developed recently especially for diagnostics of Alzheimer's disease provides promises for very early diagnosis of the disease.

## **Detecting changes in the electrophysiology of the brain**

Alzheimer's disease is known to affect the electromagnetic activity of the brain. In PredictAD, we have studied the performance of a novel technology, transcranial magnetic stimulation (TMS) combined with electroencephalographic (EEG) measures in detecting the disease. The strength of TMS/EEG is that it allows direct and non-invasive perturbation of the human cerebral cortex without requiring the subject's collaboration. Our study has shown significant changes in Alzheimer's patients compared with healthy aging people.

## **Non-invasive techniques to find biomarkers of the disease**

Molecular level biomarkers are currently under extensive studies in Alzheimer's research. Many biomarkers, such as tau proteins and b-amyloid 42, measured from the cerebrospinal fluid (CSF), the liquid surrounding the cerebral cortex, have been found to be strongly related with the disease. One major challenge of these biomarkers is that taking samples from CSF is an invasive measurement limiting their usability in early diagnostics. Blood samples would be an excellent source for

detecting Alzheimer's disease as blood sampling is not considered an invasive technique. PredictAD has studied the role of metabolomic and protein compounds in Alzheimer's disease from blood samples. The preliminary results reveal several promising compounds.

## **Methodology for measuring the state of the patient**

Currently, clinicians make the final diagnosis by combining heterogeneous measurements with information from interviews of the patient and relatives. This process involves subjective reasoning and requires strong expertise from the clinicians. Modern hospitals have huge data reserves containing hidden information that could be utilised in diagnostics by systematic mathematical modelling.

PredictAD has designed a totally novel approach for measuring objectively the state of the patient. This decision support system, developed in close collaboration with clinicians, compares patient measurements with measurements of other patients in large databases and provides at the end an index and graphical representation reflecting the state of the patient. "The PredictAD tool provides a new option to support decision making", says Prof. Hilikka Soininen from the University of Eastern Finland, leading the clinical validation of the project.

## **Possibilities for significant savings in health costs**

Prof. Gunhild Waldemar from Copenhagen University Hospital, Rigshospitalet emphasises the importance of the Alzheimer's disease research: "Successful, early diagnostics combined with the novel drugs under development and early psychosocial care may delay the institutionalisation of patients, reducing suffering and the costs to the society. It has been calculated that delaying the onset of the disease by

five years would halve all costs of Alzheimer's disease and delaying onset and progression by only one year would reduce the number of Alzheimer's cases by about 10%."

"Diagnostic companies like GE Healthcare and pharmaceutical companies are investing heavily in this area. Commercialisation of the results is already ongoing in PredictAD", says Dr Lennart Thurfjell from GE Healthcare Ltd leading the activities of dissemination and exploitation.

Dementia has been recently identified as a health priority both in Europe and in the USA. Alzheimer's disease, the most common cause of dementia, alone accounts for costs equivalent to about 1% of the gross domestic product (GDP) of the whole world and the number of persons affected will double in the next 20 years. Early diagnostics plays a key role in solving the problem because treatments of this irreversible disease should be started in an early phase to be efficient. Various treatments are currently under extensive development. So far, the lack of systematic and objective ways to identify persons for treatments has been apparent.

With a consortium of top-level European research and industry partners, the PredictAD project takes an important step towards an early approach to Alzheimer's disease prediction and management. Public and private partners from eight research, academic, industrial and medical organisations from five different European countries form the consortium: VTT (Finland), GE Healthcare (UK), Nextim Ltd. (Finland), University of Eastern Finland (Finland), Imperial College London (UK), Karolinska Institutet (Sweden), University of Milan (Italy) and Copenhagen University Hospital, Rigshospitalet (Denmark).

PredictAD is organising a workshop in Kuopio, Finland, on June 15, 2011. The purpose of the workshop is to present and discuss results of

the PredictAD project and recent innovations for the early diagnosis of [Alzheimer's disease](#).

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