The Dementia Centre and the Bioinformatics Department of the Cyprus Institute of Neurology and Genetics join forces towards better prediction and monitoring of dementia

Dementia Centre at the Cyprus Institute of Neurology and Genetics (CING)

The Dementia Centre at the Cyprus Institute of Neurology and Genetics (CING) treats and monitors patients from all over Cyprus. It offers multidisciplinary care, with a team that includes neurologists, nurses, neurophysiologists, physiotherapists, neuropsychologists, speech therapists, clinical dieticians, and social workers. The dual purpose of CING- caring for patients while leading pioneer research in Cyprus- allows scientists and clinicians to closely collaborate and effectively develop ways to better understand Alzheimer's Disease (AD) pathology. CING's Dementia Centre is an integral partner in shaping the national strategy for healthy aging and the fight against dementia.

Although Cyprus lacks recent epidemiological data for dementia, the latest report from Alzheimer Europe suggests that in 2018, 1.17% of the population in Cyprus had dementia. Based on future projections as documented in the report, this will increase to 1.26% of the population in 2025. Currently, there is an urgent need for recent data on dementia cases as Cyprus was absent in the 2024 Alzheimer Europe report.

Patients visiting the Dementia Centre are usually referred by General Practitioners. Depending on the assessment by the Neurologist who decides their course of treatment, the patients can also visit the Neuropsychologist for an in-depth neuropsychological evaluation and the Physiotherapist for the assessment of their movements. If necessary, patients can also be referred to a Speech Language Pathologist, a Nutritionist, and Neurophysiologists in CING. Patients have regular follow ups depending on the course of treatment decided by the healthcare professionals. They also have the option of opting in Research Projects running at CING, given they or their caregivers provide their informed consent.

The Bioinformatics Department at the Cyprus Institute of Neurology and Genetics (C-BIG)

C-BIG is a high-level interdisciplinary team that was established in 2016 to host the European Bioinformatics Research Area Chair in Cyprus with the support of the EU H2020 ERA Chair Grant BIORISE, for the period 2015-2020, and has since been transformed into a permanent department within the Cyprus Institute of Neurology and Genetics (CING). The Department's mission is to serve as a centre of excellence in applied bioinformatics for early diagnosis, effective prognosis and drug discovery, contributing to the vision of precision and personalized medicine. This is achieved through cutting-edge bioinformatics research, postgraduate training and the ongoing development of bioinformatics methods and tools, either as services or as publicly available applications. The Department's research focuses on advanced computational diagnostics and therapeutics. We have a strong interest in applying advanced computational methods such as network analysis, machine learning/deep learning, multi-source data integration and modelling to biomedical problems to address issues of complexity, find hidden criticalities, monitor the systemic changes and ultimately approach with computational methods the most challenging questions related to human health, such as understanding the molecular mechanisms underlying disease and proposing candidate biomarkers/new or repurposed drugs for specific diseases or disease stages.

Dementia Research at the Cyprus Institute of Neurology and Genetics

CING is involved in the large European study FINGERS aiming to observe how lifestyle can affect cognitive decline in the Cypriot population. Also, CING participates in an Alzheimer's Association funded study which aims to identify the role of probiotics in patients with Mild Cognitive Impairment (MCI). Finally, CING has a significant publication record in the field of dementia, ranging from clinical and basic research to bioinformatics and translational research. CING has recently joined the COMFORTage consortium and will conduct Pilot Study 8.

The role of the Cyprus Institute of Neurology and Genetics within the COMFORTage Consortium

CING is responsible for the recruitment of approximately 100 people who are either Alzheimer's disease patients or have cognitive impairment. Additionally, 50 people without any signs of memory impairment will participate as healthy controls. Given that the patients fulfil all the criteria for participation to this research, they will be invited by their neurologists. Healthy controls are individuals who will be invited either by their local General Practitioners or via reach-out activities on dementia awareness organised by CING. Potential participants will be informed on the details of their participation and if they agree they will be signing a consent form and completing a questionnaire on their demographic information.

Furthermore, visits to the different healthcare professionals will be scheduled. During their visit to the Neurologist, participants will be assessed on their cognition and frailty. Then, they will be assessed by a Physiotherapist who will examine their movement. The Neuropsychologist will be responsible for running a variety of neuropsychological

assessments while the Neurophysiologist will perform electroencephalogram- an examination of the brain signals.

Additionally, what is unique in CING's Pilot 8 is:

(a) The series of swallowing studies and the assessment of dysphagia (difficulty in swallowing) which are going to be performed. Although its existence in dementia patients is undeniable, this is a relatively understudied aspect of the disease. Our study aims to better describe dysphagia especially in the early stages of dementia, with the ultimate goal of properly monitoring symptoms early on, before patients reach malnutrition.

(b) The multimodal data integration that will allow for comprehensive profiling, network analysis and enhanced machine/deep learning. The CING's Bioinformatics department (C-BIG) has expertise in handling all forms and types of data, including clinical, biochemical, genetic and molecular data. C-BIG will be responsible for the processing and analysis of the data collected under the project's scope and the statistical and functional interpretation of the results. The data comprise clinical, biochemical, imaging, physiological, neuropsychological, proteomic, metabolomic, demographic and lifestyle variables. The bioinformatics and statistical analyses will potentially classify dementia patients in different dysphagia stages.

All the participants will have at least one follow-up visit while dementia cases in particular will be more closely monitored through more frequent visits. This will allow us to assess the needs of patients and their care-givers depending on the disease stage. Importantly, all the processes regarding the participation of individuals in COMFORTage were reviewed and approved by the National Bioethics Committee and are in alignment with the rest of the COMFORTage Pilots.

The role of CING in COMFORTage

The comparison of healthy, mild cognitive impairment, and Alzheimer's disease patients through a variety of clinical and molecular tests will allow us to make observations regarding the progression of disease in time. The combination of these data through modern multi-modal data integration techniques will enable a **more accurate prediction** of dementia and allow time for early interventions to **delay or even prevent dementia**.

CING is a proud member of the COMFORTage Consortium. By integrating medical, technological and computational expertise, the Departments of Neuroepidemiology, Neurophysiology, Neuropathology, and Bioinformatics are working together to advance the fight against dementia.

COMFORTage

Flow of Pilot 8

Neurologist

Neuropsychologist

Physiotherapist

Speech Language Pathologist

Neurophysiologist

Bioinformatic analyses