BACKGROUND: THE REVERSIBLE DEMENTIA PROJECT (REVERT)

Oct 2020–Jun 2023: The Reversible Dementia Project (REVERT)
Budget: €3.5m, of which €2.4m funded by the European Regional Development Fund via the Interreg France (Channel) England Programme
Website: https://revertproject.org

About 1.2 million people in France (French Alzheimer's Society) and about 850,000 in the UK are affected by dementia (UK Alzheimer's Society). With growing ageing populations in both countries, these figures are projected to rise significantly over the next twenty years.

Care for dementia sufferers is costly and is an increasing challenge facing the Channel area. The average annual costs of dementia care per affected person in the UK is estimated at £32,250, and €22,099 in France.

Normal pressure hydrocephalus (NPH) is a form of dementia caused by impairment of the circulation of the fluid that bathes the brain and spine (a type of cerebrospinal fluid disorder). Unlike Alzheimer's disease, it can be potentially reversed by surgically implanting a shunt.

This is important because 5–15% of dementia patients (equivalent to about 65,000–200,000 people) are misdiagnosed with Alzheimer's each year and should instead be treated for NPH.

The REVERT project will address this by implementing innovative medical tools developed by project partners to diagnose NPH patients quickly and accurately as part of an integrated care pathway.

The project, which brings together world-leading expertise from Amiens (brain flow diagnostics) and Cambridge (brain pressure), will lead to improved diagnostic efficiency of NPH, which in turn will improve patients' chances of leading a more independent life, with significant predicted cost savings on future health and social care provision.

The participating institutions and their roles are:

The University of Cambridge Brain Physics Laboratory (UK), which will study cerebrospinal fluid (CSF) dynamics and multimodal brain monitoring

Cambridge University Hospitals (UK), which will evaluate the feasibility of the combined package of infusion tests (pressure measurement) and dynamic CSF movement studies (using PC MRI) in daily clinical practice. CUH will also host the project's clinical lead, and will work jointly with the University of Cambridge to provide training and support in implementing the NPH care pathway across all four clinical centres participating in the project

The University of Picardie Jules Verne (France), which will build a digital model dedicated to the interaction of fluids in the cranial system from new measurements, intracranial flow and pressure, obtained within the project

The University of Artois (France) Laboratoire de Mathématiques de Lens (LML), which will primarily focus on mathematical/deep learning models for the prediction of NPH treatment responders. It involves careful analysis of the data produced by the project and an exploration of the existing neural network architectures to identify models that best fit the problem of NPH diagnosis.

The University Hospital of Amiens (France), which will primarily focus on implementing the phase contrast MRI-based diagnostics of hydrocephalus in the other hospitals of the partnership including teaching and training, recruitment of patients to undergo both diagnostic tests (flow and pressure), as well as the development of new software for analysis and coupling of intracranial pressure and flows.

The University Hospital of Brest (France) Neurosurgery Department, which will implement the pressure and flow diagnostic procedures in the hydrocephalus clinic and recruit patients for this study as well as lending their clinical experience to the research and development part of the project.

The University Hospital of Caen (France), which is committed to providing the population of Lower Normandy and surrounding areas with quality care and up-to-date standards of the most modern techniques.

Obex Technologies (UK), which is leading on the clinical informatics work package, including the development of the Hydrocephalus Management Platform and all its associated data security and governance protocols.

Related past projects

2013-2020: Collaborative European NeuroTrauma Effectiveness Research in TBI (CENTER-TBI)
Budget: €40,000,000
Website: https://www.center-tbi.eu

Traumatic brain injury (TBI) affects over 2 million people in Europe and causes 75,000 deaths. EU funding supported an initiative to develop evidence-based treatment recommendations. This 6.5-year project was part of The International Initiative for Traumatic Brain Injury Research (InTBIR).

CENTER-TBI 2013-2020, EU Grant Agreement ID: 602150, budget €40,000,000
Co-chaired by LP, UoC, with Brain Physics leading the efforts in collection of physiological monitoring data from European ICUs, managing their own budget of £390,000 and resulting in 26 publications to date.

The 42 participating institutions include the University of Cambridge, which received an EU contribution of € 2,997,529.

2007-2013 France (Channel) - England (FR-UK):
Physiology and physiopathology of the fluids, tissues, pressure interactions in the human central nervous system (INTRAMES)
Budget: €658,262
EU page: https://keep.eu/projects/7872/Physiology-and-physiopatholo-EN/

From 2007 to 2013 Cambridge University Hospital, together with the University of Cambridge Brain Physics Laboratory, ran a successful EU Interreg project with the University of Amiens. A number of highly cited papers were written and published together with the University of Amiens (a total of 15). This formed the basis for further development of pressure-flow studies in Normal Pressure Hydrocephalus, which will be finalised within the scope of the REVERT project.
Some important papers include:
1: Adam A, et al. Fluids Barriers CNS 2017. PubMed PMID: 28929972
2: Capel C, et al. Neurol Res 2014. PubMed PMID: 24512019.
3: Balédent O, et al. Acta Neurochir (Wien) 2019. PubMed PMID: 30421028

The INTRAMES project has direct relevance to the REVERT project. It resulted in 15 publications and many conference talks. It showed the capacity for collaborative work

between the Amiens and Cambridge groups and the added value of cross-border cooperation.

The main objective of the INTRAMES project was to improve the care of patients with cerebral hydrodynamical disorders by jointly developing a new diagnosis and investigation tool for these disorders. The second objective was in relation to global understanding of cerebral hydrodynamics. To reach this goal, INTRAMES planned to build the first multicompartmental (CSF, blood, brain) phantom to study the interactions between CSF (cerebrospinal fluid) flow and ICP (intracranial pressure) in vitro during an infusion test, starting from a shared methodological approach.

Participating institutions:

- **Centre Hospitalier Universitaire d'Amiens**
- **University of Cambridge**

Main achievements:

- Setting up of MRI flow acquisition methods in Cambridge
- Setting up of Amiens' MRI flow analysis software in Cambridge
- Inclusion of more than 20 patients undergoing flow measurements resulting from MRI acquisition and ICP direct measurements
- Development of software combining MRI flow and ICP measurements
- Development of the phantom final blueprints and complete bench experiments
- Flow measurements on more than 30 patients
- In vivo numerical model validation
- Submission of 15 articles and participation in conferences