## Integrating multimodal, multiscale imaging and artificial intelligence for early amyloid detection in their native environment

Alzheimer's disease (AD) is the most common progressive and irreversible form of dementia. In the early stages of the disease, short-term memory is affected, but as the disease progresses, the individual becomes completely dependent on care and assistance, even for the simplest daily tasks. The disease was first described by the German neuropsychiatrist Alois Alzheimer when he discovered specific brain lesions called amyloids. These amyloids consist of specific proteins that for unknown reasons, begin to misfold, accumulate and eventually clump together, which typically begin to form many years prior to the onset of symptoms associated with the disease. As such, the ability to detect amyloid proteins could be a game-changer in preventing and fighting AD.

In the current proposed project, experts from different fields will be brought together to study said amyloids in their native environment (i.e., brain tissue). To do so, advanced imaging techniques combined with artificial intelligence (AI) will be employed to identify various types of amyloids and gain a better understanding of their structures. Complex data will be analyzed with the use of AI, which will aid in detecting early and subtle amyloid structural changes. This project could pave new ways of detecting AD before the onset of symptoms.

The current project specifically aims to: 1) develop a detailed picture of the molecular makeup of brain tissue affected by AD by combining different imaging techniques with AI; 2) gain a better understanding of amyloid toxicity by exploring how various amyloid structures create harmful effects on the brain; and 3) study amyloid formation by exploring how amyloids are produced in living systems (e.g., in genetically modified mice and human tissue models of AD).

Our team is comprised of global scientists, each bringing diverse skills, knowledge, and expertise. Our collaborative efforts will include PhD students working closely with team members of various fields of expertise, allowing them to learn and contribute to scientific knowledge. Of particular importance, our highly inclusive approach will help strengthen our research and lead to novel approaches in addressing AD.