Project 1.6 Blood plasma microRNA profile as a basis for detecting Alzheimer's disease and dementia risk in pre-symptomatic individuals

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Background:

The most common cause of senile dementia is the incurable Alzheimer's disease (AD) affecting 50 million people worldwide. The main reason for the lack of effective treatment is the complex and unclear causes of AD. In most cases, AD develops sporadically and develops asymptomatically for many years. At this stage, however, there are many changes at the molecular level that may manifest as subjective cognitive decline (SCD). These changes are not detected by neuropsychological tests, but they are risk factors for the development of AD. The second group of people with an increased risk of AD are carriers of a rare form of the gene encoding the apolipoprotein type E4 protein (APOE4). Some people at risk for AD will develop symptoms of dementia. Currently, however, there are no biomarkers that would allow to detect this disease at such an early stage. It is known that early detection of the risk of AD is critical for prevention and effective therapy. Biomarkers present in easily accessible tissues, such as blood, that could be detected by simple and accessible methods are the most sought after.

This project addresses these challenges based on the results of several of our previous studies that led to the discovery and patenting of the molecular signature of AD in blood plasma in the form of a set of microRNA (miRNA) molecules. We hypothesize that the blood miRNA molecular signature emerged in the last decade reflects the complex pathomechanisms of AD, and therefore that miRNAs are more appropriate for the early detection of this multifactorial disease than any other existing test.

Aim:

Investigating whether the miRNAs selected by us are biomarkers not only of the later stages of AD, but also of the pre-symptomatic stage in people at risk of AD (people with SCD, APOE4 carriers). We will check whether the selected set of miRNA molecules can indicate which people from the risk groups develop asymptomatic AD. We will also explain whether there are miRNAs in the set that predict the development not only of AD, but also of other types of dementia. In the research, we will use molecular methods optimized by us and machine learning methods, which are currently one of the most outstanding fields of artificial intelligence, with many applications, including in the diagnosis of diseases. **The project therefore represents research that could revolutionize the future diagnosis of AD and enable early preventive testing or individualized therapies**.

Requirements:

- Master's degree in molecular biology, biochemistry, biotechnology or a related discipline,
- experience in working in a laboratory,
- previous RT-qPCR experience is an asset.