A microchip to analyze trafficking leukocytes in Alzheimer’s disease patients

https://neurodegenerationresearch.eu/survey/a-microchip-to-analyze-trafficking-leukocytes-in-alzheimer%c2%92s-disease-patients/

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Title of project or programme

A microchip to analyze trafficking leukocytes in Alzheimer’s disease patients

Source of funding information

NIH (NIA)

Total sum awarded (Euro)

150473.3945

Start date of award

01/06/2016

Total duration of award in years

1

Keywords

Acquired Cognitive Impairment... Aging... Alzheimer's Disease... Alzheimer's Disease including Alzheimer's Disease Related Dementias (AD/ADRD)... Bioengineering... Brain Disorders... Dementia... Immune System... Neurodegenerative... Neurosciences... Prevention

Research Abstract

? DESCRIPTION (provided by applicant): Alzheimer’s disease (AD) is one of the most common neurodegenerative diseases that lead to detrimental outcomes such as progressive memory deficit and cognitive impairment. Although it is expected that the prevalence of AD will double over the next 30 years, currently no widely-accepted molecular biomarkers for early detection or

non-invasive monitoring of AD. There has been increasing evidence that immune responses and brain inflammation are involved in the pathogenesis of neurodegenerative disorders in the central nervous system (CNS). The immune cells participating in the inflammatory response in the deep brain often get into cerebrospinal fluid (CSF), so called the “”circulatory”” system of CNS, and these cells carry the information about deep brain inflammatory pathology. On the other hand, while the blood-brain barrier (BBB) restricts the entry of immune cells into the CNS, a small number of immune cells can traverse into the CNS during pathophysiological states to participate in immune surveillance. Excessive migration or abnormal functioning of these immune cells contribute to the development of neurodegenerative pathology. It has been hypothesized that these trafficking leukocytes in CSF are potential cell markers to detect and measure inflammatory neurodegenerative disease. However, it remains challenging due to (i) the paucity of trafficking leukocytes (~1 cell/microliter) and (2) the high degree of cellular heterogeneity with diverse immune effector functions/proteins secreted by cells (up to 40). IsoPlexis has a prototype hand-held technology that for the first time provides the ability to measure many (up to 45) of these key effector proteins at the single cell level. At the same time, this device in its envisioned form requires much less amount of cell input (~1000) representing a major advantage over the existing single-cell instruments (e.g., flow cytometer) for the specific application toward the analysis of rare trafficking leukocytes. It will also be far less costly tha existing single-cell instruments, representing a significant market advantage. Thus, we plans to develop a fully integrated system that incorporates the enrichment of trafficking leukocytes using nanorough surfaces and single-cell effector protein analysis on the same microdevice to truly enable the opportunity for wide-spread use of trafficking leukocytes as the biomarker for early stage diagnosis and monitoring of inflammatory neurodegenerative diseases (specifically AD). To reach this goal, we propose: 1. Incorporating a cell capture module in the IsoPlexis microdevice to perform on-chip separation of low abundance leukocytes followed by highly multiplexed immune function analysis. 2. Develop an integrated carrier device to perform reliable operation of the integrated microchip for measuring rare trafficking leukocytes from CSF. We expect to develop a unique and minimally invasive approach to quantitatively measure inflammatory conditions in deep brain for early diagnosis and therapeutic monitoring of AD using CSF. This approach will also have broad impact on preclinical or clinical uses for routine screening or monitoring of inflammatory neurodegenerative diseases.

Further information available at:

Types:
Investments < €500k

Member States:
United States of America

Diseases:
N/A

Years:
2016

Database Categories:
N/A

Database Tags:
N/A